

# DRUMHELLER FLOOD MITIGATION and CLIMATE ADAPTATION SYSTEM

## Changing the Channel of Flood Readiness



Flood Mitigation and  
Climate Adaptation  
System

**SEPTEMBER  
2020**

Systeme d'atténuation  
des inondations et  
d'adaptation au  
changement climatique

**SEPTEMBRE  
2020**





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## Drumheller Flood Mitigation and Climate Adaptation System: Changing the channel on flood readiness

<b>WHO:</b>	Town of Drumheller
<b>WHAT:</b>	Flood Mitigation and Climate Adaptation System
<b>WHERE:</b>	100 kilometers of riverbank in the community of Drumheller
<b>WHEN:</b>	2019 - 2024
<b>HOW:</b>	Drumheller Resiliency and Flood Mitigation Office
<b>HOW MUCH:</b>	Funding total: \$55M

### Overview

In March 2019, the Government of Canada committed funding in the amount of \$22M to Drumheller's Flood Mitigation and Climate Adaptation System through the Government of Canada's Disaster Mitigation and Adaptation Fund (DMAF). The Government of Alberta also committed \$28M in funding to this project through the Alberta Community Resiliency Program (ACRP). With the additional municipal investment of \$5M, a total of \$55M has been dedicated to the Drumheller Flood Mitigation and Climate Adaptation System to change the channel on flood readiness in the community.

# LEVERAGE. INTEGRATE. LEGACY.

We are committed to leveraging opportunities, integrating approaches to flood mitigation and building a legacy in a proactive and sustainable way. This will form the basis of a 3-word community 'Pledge' for the program.



*Honourable François-Philippe Champagne, Minister of Infrastructure and Communities, Mayor Colberg and Councilor Jay Garbutt announce DMAF funding to Town of Drumheller*

## WE'RE CHANGING THE CHANNEL ON DRUMHELLER FLOOD READINESS!

[DRUMHELLER.CA](https://drumheller.ca)



## Drumheller Resiliency and Flood Mitigation Office

The purpose of this office is to protect the people and property in Drumheller from loss due to flooding through a sensible model for a small community to adapt to the perils of changing climate. The Resiliency and Flood Mitigation Office will manage the Flood Mitigation and Climate Adaptation Plan through to its completion in 2024.

**Mission:** Protect residents and property from loss or injury related to the perils of flood and changes in climate.

**Goal:** Preserve the value of property and ensure risk is reduced to levels which allows financial and insurance products to remain available.

**Aim:** Implement a comprehensive mitigation program for flooding and adaptation to changes in climate by 2025 with the following objectives:

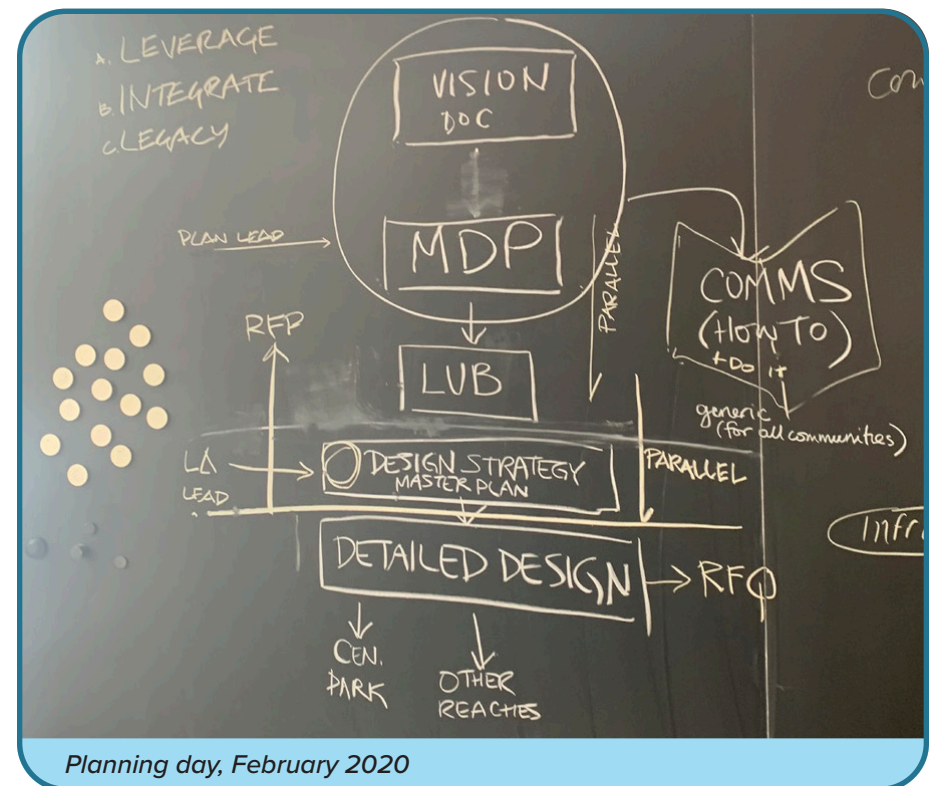
1. Communication and public engagement
2. Regulatory/approvals
3. Conveyance capacity
4. Structural measures
5. Municipal Emergency Plan (MEP)

Council took a bold step in hiring an expert team of seasoned practitioners that have been through flood, fires and major community disasters to help manage the project and address the concerns of the community. For the first time in our community, a Chief Resiliency and Flood Mitigation Officer was hired to lead this team and ensure that Drumheller is flood ready and that resident concerns are addressed pre-flood, during a flood and post-flood.

The creation of the Resiliency and Flood Mitigation Office will follow the principles of the internationally recognized Incident command System (ICS).

## January – June 2020

This report is intended to provide governing bodies and key stakeholders an overview of the current and planned objectives for the Drumheller Resiliency and Flood Mitigation Office. Forward progress has been achieved on many of the initiatives in face of the COVID-19 global pandemic. It has been a struggle to communicate with new electronic means and conduct field inspections and orientations with various consultants and stakeholders. We thank all who have participated and their patience during this time.



## Communications and Engagement

Creating and implementing a communication plan and an inclusive public engagement and stakeholder strategy is a critical part of this initiative. The need to work with the community, businesses and residents, to take on ownership and responsibility in helping change the channel on flood readiness in Drumheller is very important. The following communications activities and stakeholder engagement occurred from January – June 2020:

- Indigenous consultation and engagement:
  - » Stoney Nation – correspondence with no return answer (January 30)
  - » Siksika First Nation meeting to confirm project details and desire to meet in spring to conduct ceremony prior to traditional use study (February 3) – postponed due to COVID-19
  - » Blood Tribe – meeting at Grey Eagles Resort to provide overview of program. Interest in historical resource and archaeological findings in prescribed area. Will schedule site visit in mid spring (February 10) – postponed due to COVID-19
  - » Tsuut'ina First Nation – meeting at tribal office. Provided overview of program interested in ceremony in advance of work commencing. Will schedule meeting in mid Spring (February 10) – postponed due to COVID-19
  - » Siksika Nation Council meeting with Mayor Colberg – interest in joint council meeting and exploring opportunities to develop long term relationship (March 5)
  - » Received positive feedback from Infrastructure Canada that they are satisfied and pleased with approach to consultation and engagement town has adopted in regards to Indigenous Consultation process to date (March 10)
- Crisis Communications training held for Town staff and council



- Video produced showing highlights from winter river inspection
- Launched dedicated Flood Readiness Website (February 5)
- Implementing public education campaign based on themes: Be Informed. Plan Ahead. Take Action – over 40 social media posts
- Video update with Mayor Colberg on flood maintenance at Newcastle Beach
- Developed educational opportunities to be delivered to Grade 4 students canceled due to COVID-19 school closures
- Nine project updates highlighted on dedicated Flood Readiness website:
  - » Land Acquisition Policy (January 20)
  - » Website Launch (February 5)
  - » Family Day Activities (February 18)
  - » Flood Mitigation Maintenance Updates (March 4)
  - » Flood Season Reminder (May 15)

- » River Updates (May 25, June 1)
- » Flood Mitigation Surveying (June 9)
- » Urban Forest Surveying (June 10)
- Adopting Land Acquisition Policy and Process
- Engaging with affected homeowners impacted by Land Acquisition Stage 1
- Flood Forum with other DMAF recipients and academia planned for April 19-22 to show leadership and provide an opportunity for municipalities and experts to share best practices in mitigating flooding disasters – postponed due to COVID-19
- Held two mitigation system inspections/orientations
- Held meeting with local contractors to review flood mitigation project opportunities
- Held meeting with local realtors to discuss land acquisition policy and process
- Developed phone scripts for town staff to assist in answering frequently asked questions
- Five flood advisory committee meetings were held to provide status updates
- Twenty-five weekly team meetings conducted to coordinate activities and consolidate communications
- Meeting with Palliser Regional Municipal Services in Hanna
- Five planning technical meetings with O2 Design as it relates to Master Engineering Design and Assessment of Planning Impacts
- Coordination of communication strategies with O2 Design



## Regulatory/approvals

Work continues on the complex regulatory and approval process that is integral to this program. This includes:

- Meeting with Alberta Environment and Parks (AEP) operations branch to identify transfer methods (moved to Q3 as a result of COVID-19)
- Continuing discussions on transfer methods
- Meetings with AEP and Public Lands to discuss the transfer of lands and dikes
- Meetings with AEP Flood Hazard Mapping Section (February)
- Held routine meetings with Palliser Regional Municipal Services, our regional planning provider
- Actively participating in monthly Municipal Planning Commission Meetings to provide strategic advice relating to flood mitigation matters

## Conveyance capacity

An important part of this initiative is making room for the river which includes planning and outreach. The following was achieved from January – June 2020:

- Cross drain preparation and exploration for improvements
- Drainage ditch flow improvements
- Newcastle Beach brush grubbing preparation for improvements with Drumheller Institution work release program
- Excavated 6200 m<sup>3</sup> of material from Newcastle beach to improve river flow
- Improvements to high water emergency boat access
- Wayfinding sign for passive warning system – delayed due to COVID-19



River inspection, March 2020

## Structural measures

In the first half of 2020, we continue to work on the structural foundation for the Flood Mitigation and Climate Adaptation System:

- Winter river inspection to address stability and erosion issues
- Sourced material for berm construction for both flood mitigation project work scopes and emergency berm work
- Legal surveying of existing berms that will allow for licensing and registration of the land as part of the existing flood system
- Geography and Information Technology students from Southern Alberta Institute Technology (SAIT) commenced inventory of trees throughout the valley. This will assist in determining how much green house gas is being captured and the cooling measures. This asset inventory will also determine the life expectancy of the trees and how many replacement trees need to be maintained at the tree farm at the Drumheller Institution
- Met with the Drumheller Institution to discuss collaboration with Drumheller's inmate Work Release Program to include:
  - » Tactical emergency response planning
  - » Tree farm maintenance
  - » Manufacturing warning signs
  - » Work release programs
- Held Workshop and scoping exercise with land-use landscape architecture focused on translating mandates, story and vision for the Drumheller Valley into better defined project scopes
- Completed a review of existing MDP and LUB, and identified areas for improvement in both content and process to meet flood mitigation requirements
- Engaged in workshops and conversations with our steering and technical committees that have helped us understand the new set of intents and priorities that will shape the next decades of planning and development

- Used DRFM targets to review flood impacts, existing infrastructure, and mitigation as key variables that are giving shape to planning strategy, both for implementing flood protection, connecting the valley, and for shaping future growth
- Built a rich library of layered stories about the valley that will guide the experience and curation of the valley as a world-class destination
- Prepared a preliminary land use framework that incorporates all the considerations above
- Structural measures update and barrier alignment
- Municipal Development Plan and Land Use Bylaw – conceptual Planning framework, initial policy direction and proposed LUB approach
- Two meetings with the MDP/LUB impact study steering committee to review work and align direction for committee
- Developing maintenance and operations manuals for the dikes and the maintenance of dikes – moved to Q3 as a result of COVID-19
- Preparing land assembly packages including crossing agreements and right-of-way agreements – moved to Q3 as a result of COVID-19
- Engaged Palliser Regional Planning to ensure coordination of the current and future development procedures and protocols for the Town of Drumheller

## Municipal Emergency Plan

While the COVID-19 global pandemic has created unprecedented challenges to municipalities, one main benefit of the Town of Drumheller's response has been increased staff training and awareness to Incident Command System processes. Additional improvements include:

- Increased awareness ICS to all Town employees
- Email availability to all Town employees
- Council increased awareness to ICS processes and EOC operations
- Improved EOC technology

As we continue to update the MEP, we are also working on developing and expanding it beyond planned success and focusing on recovery by awfulizing potential event scenarios.





## Finance

Finance and Administration activities are a key contributing factor to the success of the Flood Mitigation and Climate Adaptation System. From January – June 2020 the following have been completed:

- Alberta Community Resiliency Program (ACRP) contract terms were agreed to with amendments
- Negotiations are ongoing for the contribution agreement with Government of Canada
- Grant investment \$20,000,000 with local Credit Union
- Completed Climate Lens GHG Mitigation Assessment Draft Report
- Set up office to function as DFRM program operations center
  - » Renovations of offices including: finish walls, ceiling, floors and electrical on operations room, framing, electrical, drywall, painting operations and briefing Rooms, electrical, sprinkler relocation in operations room, flooring in operations room and install electronic equipment
  - » Hired local business to run computer cables install backbone for technology set up
  - » Installation of computer cables and monitors
- Developed and implemented record management system
- Developed and implemented organizational systems and controls
- Reviewed and established purchasing policy that acts as checks and balances for purchases within the program
- Purchased notebooks and recycled computers from local organization
- Set up accounting software and protocols
- Established backbone for information systems and flow of data and information for the DFRM Program
- Purchased and set up ARCview software for utilization
- Developed and awarded following service contracts:
  - » Centennial Park Flood Barrier Site Concept Plan – O2 Planning and Design



*Chief Resiliency and Flood Mitigation Officer,  
Darwin Durnie, March 2020*

- » Master Engineering Design and Assessment of Planning Impact – O2 Planning and Design
- » Finance and Management Audit – Ascend Financial
- » Hydraulic Analysis, Flood Mitigation Measures Overview, Conceptual Design and Cost – Northwest Hydraulics
- » Cathodic Protection – ASM Controls
- » Geotechnical Services – Parkland Geo Tech
- » Surveyor of Record – Hunter Surveys
- » Surveying Services – Vector Surveying & Hunter Wallace
- » Inspect Flood Mitigation Berms and coordinate Flood Zone Geotech – Sweet Tech Engineering
- » South Drumheller Storm pond Design
- Purchased goods and services from 22 local companies including:
  - » South Drumheller Storm pond Design
  - » 1477834 Alberta Ltd

- » Ascend LLP
- » Big Country Graphics
- » Big Country Victim Services
- » Bright Valley Electrical
- » Critters
- » Drumheller Equipment Sales and Rentals
- » Drumheller Mail
- » Gary's Welding
- » Grants Oilfield
- » Herman Kloot and Company
- » Hunter Survey Systems Ltd.

- » Hunter Wallace Surveys
- » James Martin
- » KC Hydrovac
- » Lee Boreneim
- » Out Lawns Tree Service
- » Palm Engineering
- » Reality Bytes
- » Reg Gallagher Trucking
- » Vector Surveys
- » Zucatto Landscaping



*Gordon Taylor Bridge February 2020*



*Wayfinding Sign manufacturing for passive water earnings. Manufactured locally, Garry's Welding.*



*Drainage ditch clearing of fallen tree debris to facilitate inspection*

**Town of Drumheller | Drumheller Resiliency and Flood Mitigation Program (DRFM Program)**  
**3rd Quarter Financial Report | Overall Project Summary**  
**September 30, 2020**

	Total			2019	2020			2021	2022	2023	2024
	Estimate		To Date	Actual	Budget	Estimate	To Date	Revised Estimate	Revised Estimate	Revised Estimate	Revised Estimate
	Initial	Revised									
<b>Revenue</b>											
DMAF Program Funding	\$22,000,000	\$22,000,000			\$8,000,000	\$8,195,019	\$0	\$5,804,981	\$3,520,000	\$4,480,000	
AB Environment Property Buy Out	\$20,000,000	\$20,000,000	\$20,000,000		\$20,000,000	\$20,000,000	\$20,000,000				
AB Environment Infrastructure (In Kind)		\$0				\$0					
Community Resiliency Program											
East Midland, Newcastle Projects	\$3,211,000	\$3,211,000	\$3,211,000	\$3,211,000							
Central Drumheller Project	\$3,202,600	\$3,202,600	\$3,202,600	\$3,202,600							
	\$6,413,600	\$6,413,600	\$6,413,600	\$6,413,600							
Interest - General Project Fund		\$323,746	\$303,217	\$262,114		\$61,590	\$41,103	\$30,684	\$12,590	-\$26,778	-\$16,455
Interest - Land Acquisition Fund		\$323,407	\$47,770			\$208,228	\$47,770	\$101,602	\$12,605	\$972	
DMA Regionalization Grant	\$30,000	\$30,000	\$30,000	\$30,000							
Town of Drumheller (In Kind)		\$81,018	\$81,018	\$81,018							
Town of Drumheller Cash Contribution	\$5,000,000	\$5,000,000	\$0		\$0			\$1,500,000	\$2,500,000	\$1,000,000	
	<b>\$53,443,600</b>	<b>\$54,171,770</b>	<b>\$26,875,605</b>	<b>\$6,786,732</b>	<b>\$28,000,000</b>	<b>\$28,464,837</b>	<b>\$20,088,873</b>	<b>\$7,437,267</b>	<b>\$6,045,195</b>	<b>\$5,454,194</b>	<b>-\$16,455</b>
<b>Expense</b>											
01 General Program	\$2,349,058	\$2,240,914	\$522,459	\$235,682	\$487,736	\$612,872	\$286,777	\$443,665	\$434,945	\$248,869	\$264,881
02 Project Management (Net)		\$0	\$3,407				\$3,407				
21 Indigenous Consultation	\$202,210	\$184,461	\$29,129	\$9,461	\$175,000	\$175,000	\$19,668				
41 Land Acquisition	\$20,000,000	\$20,323,383	\$787,247	\$10,927	\$12,172,538	\$12,805,056	\$776,321	\$6,446,093	\$987,307	\$74,000	\$0
60 Infrastructure	\$30,893,332	\$30,713,616	\$783,057	\$74,052	\$6,220,620	\$6,275,620	\$709,005	\$9,670,982	\$8,198,549	\$6,361,538	\$132,875
76 Flood Operations Center		\$140,018	\$135,013	\$81,018		\$54,000	\$53,995	\$5,000			
81 Master Engineering Design, Assessment of Planning Impact		\$405,145	\$219,470	\$145		\$405,000	\$219,325				
91 Passive Warning System		\$165,000	\$101,790			\$160,000	\$101,790	\$5,000			
	<b>\$53,443,600</b>	<b>\$54,172,537</b>	<b>\$2,581,573</b>	<b>\$411,285</b>	<b>\$19,055,894</b>	<b>\$20,487,548</b>	<b>\$2,170,288</b>	<b>\$16,570,740</b>	<b>\$9,620,801</b>	<b>\$6,684,407</b>	<b>\$397,756</b>

## Governance

Steps have been undertaken to ensure a strong governance model is in place including the following:

- Land Acquisition Policy adopted by Council – January 20
- Council approved a Purchasing Policy for the DRFM Program which closely follows the existing Town Policy but broadens the circumstances in which sole source purchasing may be used – January 20
- Council approved the DRFM Program Budget for 2020 for inclusion in the 2020 Capital Budget with a decision deferred on the years 2021 -2024. The DRFM Program overall budget will be reviewed as part of the Program report and financial review with Council on June 22 – January 27



Team meeting March 2020

## Third Quarter Deliverables

### Regulatory & Approvals

- Historical Resource application for review submitted
- Climate Lens: Greenhouse Gas Mitigation Assessment report completed
- Land acquisition
  - › Offers made or ongoing purchase discussions, on 15

- distinct properties
- › Offers accepted on 8 properties
- › Access Agreements – to conduct further analysis for berm design
  - › 56 Agreements sought in Nacmine
  - › 17 Access Agreements executed
- Master Engineering Design and Planning Assessment
  - › Council gave first reading to two new bylaws on September 14 – Municipal Development Plan (MDP) and Land Use Bylaw (LUB)
    - › As reported in the latest Intact Centre Report – Provincial and Territorial Flood Report – August 2020, “Alberta reported that it falls below average in Land Use Planning.” DRFMO made land use planning a priority and put the river at the heart of all future planning documents. This could be recognized as a leading practice in Canada
- Indigenous Consultation site visits were put on hold due to COVID-19. Application submitted to Alberta Consulting Office for review

### Communications & Engagement

- Communications discussing the 8-steps to changing the channel
  - › Local Newspaper (Drumheller Mail) two-page spread (Sept. 16)
  - › Social media campaign (ongoing)
- Information brochures explaining the DRFMO (Aug. 26)
- Creation of educational video series “Changing the Channel”
  - › Urban Tree Strategy (June 26)
  - › Storm Detention Ponds (July 2)
  - › Newcastle Recreation Area (July 28)
  - › Flood Wall History (July 30)
  - › Focus on the new MDP and LUB and how they help with flood mitigation (Aug. 13)
  - › Berm Design (Sept. 9)
  - › Focus on the steps to become more adaptive, explaining

the new zones, strategies and why flood mitigation in the Drumheller Valley is so important (Sept. 17)

- Continued video updates with Mayor Colberg
  - » Grant Funding Announcement (Aug. 12)
  - » Dike Condition Inspection (Sept. 23)
  - » Clark Hill to Hoodoo Project Sign Unveiling (Sept. 30)



## Flood Mitigation Update: Grant Funding Confirmed

*Mayor Colberg and Darwin Durnie announce the confirmation of federal funding for the DRFMO at Newcastle Beach, August 2020*

- Launched animated educational video series
  - » Understanding Tree and Rodent Impact on Berms (Sept. 30)
- Local farmers market participating with flood mascot (Sept. 19)
- Launched “On the Trail with Morris the Hike-Asaurus” in September
  - » Weekly “blog” hosted on website and in the Drumheller Mail from the perspective of the flood mascot, provides updates in a friendly manner and addresses any misconceptions around the program
- Land Assembly information packages completed for Sept. 14
- Internal technical meetings with staff to understand impacts of new policies (ongoing)

- Website updates
- Over 65 social media posts each to drumhellerALERT Facebook and Twitter
  - » Creation of new Instagram drumhelleralert page (Sept. 20)
- Rotary Club briefing (Sept. 29)
- Regular radio and newspaper advertising as required

### Conveyance Capacity

- Swift Water Boat Rescue launched maintenance – Newcastle Recreation Area
- New Swift Water Boat Rescue launch started
- Over 5,000 trees inventoried in public lands
  - » 50 species classified and 50% of trees identified over 50 years old
- Brushing and inspection of 6.5 km of provincial dikes to determine if maintenance and repairs are required
  - » Over 20,000m<sup>2</sup> of brush/vegetation cleared



*Dike C brush clearing: before (left) and after (right), September 2020*

## Climate Change Resilience Assessment Report

Future climate projections indicate that the increase in Red Deer River flows, due to rapid snowmelt and/or higher intensity rainfall events as projected by the climate models, are likely to produce great risks to the flood protection systems and the assets in the protected areas. The 2001 Muzik report concluded:

*Small to moderate increases in rainfall intensity may have substantial impacts on flood flows, suggesting that the existing man-made infrastructures may be insufficient to deal with future floods. These results suggested that a 25% increase in extreme rainfall could lead to 40% increase in 100-year flood, 50% increase in 10-year flood, 60% increase in 3-year flood and 90% increase in 2-year flood.*

Flood events will also impact local and regional public services, due to the increased demand for emergency intervention and the need to evacuate the town.



*Crews clearing brush and vegetation for provincial dike condition inspection at Dike C, September 2020*

**“** *Flood mitigation is more than the capital investment required to build new infrastructure to minimize future risk. To maintain the resiliency of the assets you must also make operations and maintenance budgets a priority. I encourage communities to ensure adequate O&M budgets are available to maintain the life cycle of the asset.* **”**

— Dr. Guy Felio, Doctor Infrastructure

Based on the results presented in this climate risk assessment, recommendations for risk mitigation measures should be developed. Incorporating the use of standardized practices such as PIEVC and ENVISION will provide best practice guidance based on national comparisons.

- Complete a more detailed risk assessment for infrastructure components designed according to specific criteria,
- Review the design of existing flood protection dikes against projected climate change impacts.
- Consider options to increase drainage and storage capacity
- Increase availability of trained staff (including volunteer staff) to intervene in emergency situations, and further raise awareness in the community regarding flood risks and emergency preparedness
- Improve existing weather and river monitoring
- Review and improve, as needed, operations and maintenance procedures
- Review floodplain maps to reflect climate change impacts and inform land use planning.

## Greenhouse Gas Mitigation Assessment Report

The objective of the GHG Mitigation Assessment is to estimate the expected GHG emissions associated with the Project and to predict changes in GHGs associated with the Project compared to a functionally equivalent Baseline scenario. In this case, the Baseline scenario considers the situation where the dike rehabilitation/construction does not take place.

Flood damages in the Town of Drumheller are expected to amount to \$4,340,032.40 annually, on average. These average annual damages sum to \$130,200,972 in damages over a 30-year period and \$325,502,430 over the estimated lifespan of the proposed dike system (i.e. 75 years). The Project scenario involves the rehabilitation of existing dikes and the construction of new dikes over a 36-month period which will mitigate the estimated damages in the Baseline scenario and over a 75-year useful lifespan.

The Project over the span of the baseline scenario will result in an estimated net decreased of GHG emissions of 60,291 tCO<sub>2e</sub> over the lifetime of the Project. Furthermore, assuming annual damages occur in 2030 in the absence of flood mitigation, the Project will result in an estimated net GHG reduction of 949 tCO<sub>2e</sub> in 2030.

2030 GHG Emissions Results (tCO <sub>2e</sub> )		Lifetime GHG Emissions Results (tCO <sub>2e</sub> )	
Baseline scenario emissions, in 2030	949	Baseline scenario emissions, lifetime (cumulative)	74,999
Estimated Project emissions, in 2030 *	0	Estimated Project emissions lifetime (cumulative) *	14,708
Net emissions (reduction)	-949	Net emissions (reduction)	-60,291

Taking into account the amount of effort required to build dikes (such as tree hauling, vegetation grubbing, and construction) this is a significant achievement for the project in reducing greenhouse gas emissions.



*Dike B brush clearing: before (left), during (middle), and after (right), September 2020*

## 8 steps to changing the channel

To do this right, we need to put the river at the heart of our planning process. That starts with revamping the Town's foundational planning documents, the Municipal Development Plan (MDP) and the Land Use Bylaw (LUB).

The river is at the heart of our community and it needs to be at the heart of these documents as well so that all the decisions that flow from them support the vision for a safe and prosperous Drumheller.

In order to understand the impacts of flood mitigation on Drumheller current land use policies had to be reviewed.

A review of the current MDP and LUB was conducted based on the following conditions:

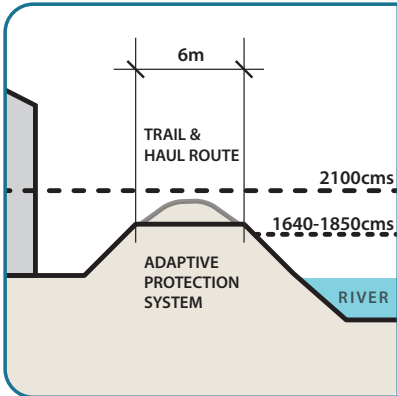
**The Rivers** — place the river at the heart of the Plan and understand channel capacity

**The Badlands** — ensure the views that make the Badlands experience are protected

**Growth Areas** — develop smart and attractive growth areas away from the river

**Neighbourhoods** — build on the unique neighbourhood identities throughout the Valley.

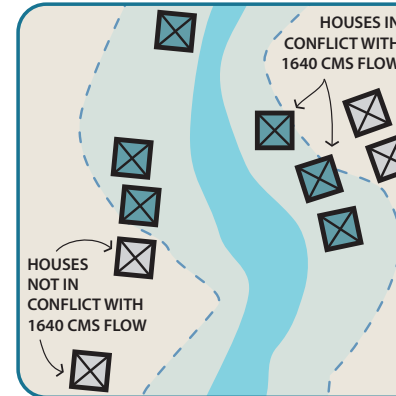
### 1. DESIGN BASIS



#### ADAPTATION

We start by **establishing a design basis**. Here, we identify the conditions that drive the design of our flood protection system. An adaptable system needs to protect to a range of flow-rates that will protect people and property in a variety of flood scenarios. We use berms that are designed to help us raise the barriers when the river rises.

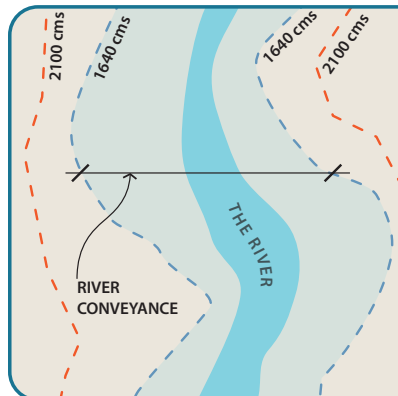
### 3. KNOW YOUR FLOW



#### UNDERSTAND THE RISK

Using the conveyance map, we can start to Know Your Flow. **Knowing Your Flow means understanding what flow rate threatens your safety and property.** Floods like those experienced in 1915 (2000 cms), 2005 (1450 cms), and 2013 (1310 cms) showed how vulnerable we can be. Knowing Your Flow helps us all prepare for the next event.

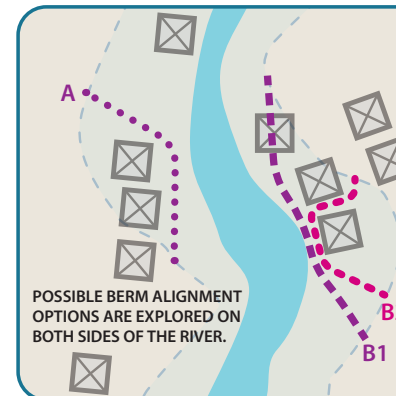
### 2. CONVEYANCE CAPACITY



#### ROOM TO FLOW

We use our target flow rates to map where the river wants to go. **The conveyance map shows us where the river needs this room to flow.** In Drumheller, there are two lines of defense: (i) 1640-1850 cms, and (ii) 2100 cms. These two lines both play important and separate roles in the multi-barrier protection system.

### 4. ALIGNMENT REVIEW



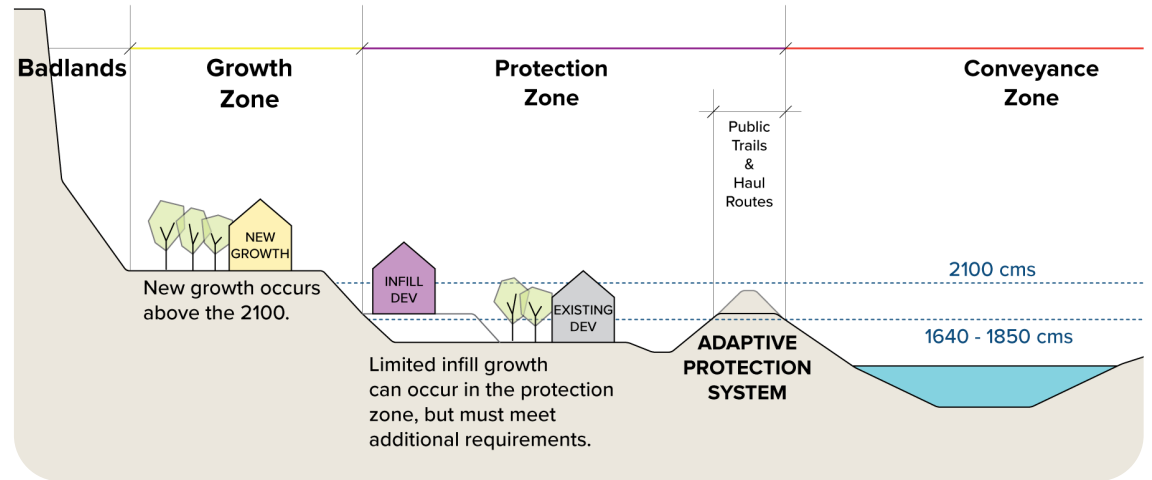
#### STRUCTURAL MEASURES

Once we know where existing development is threatened by the river, we review **potential berm alignments to understand where and what type of structural measures are feasible.** This analysis has two key goals: (i) make room for the river by keeping the channel as wide as possible, and (ii) protect existing property and assets.

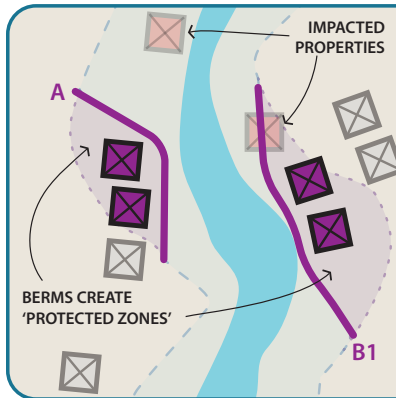


## What does it mean to have an adaptive system?

An adaptive system provides the best long-term protection and short-term cost and intrusion. Making berms adaptable means we can typically build them to lower elevations. It also means that the berm tops need to be wider, so that they can accept sufficient material and be used as haul routes when the barrier is being raised. In Drumheller, this means that adaptive berm tops need to be at least 6m wide. Having flat, wide berm tops enables the adaptive system, but it also unlocks other potentials to leverage flood measures for public trails and open space.



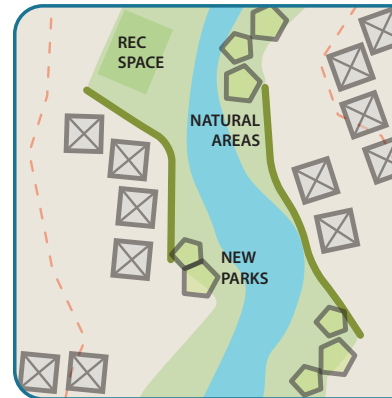
## 5. PROTECTED ZONE



### PROTECTION ZONES

Most properties can be protected by structural measures like berms, but **some are in conflict for reasons of river capacity, berm height, geotechnical considerations, cost, or operational complication**. In the figure, one house is not feasibly protected by a berm. Another house is in the path of the berm alignment that protects the most properties.

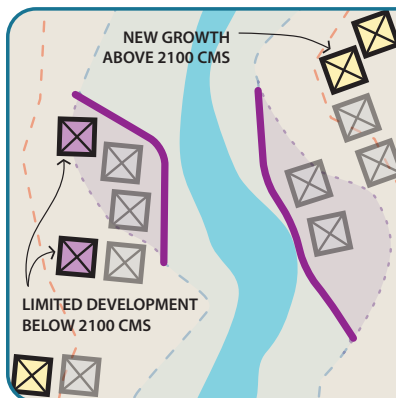
## 7. CONVEYANCE ZONE



### ROOM FOR THE RIVER

The area left to the river is called the conveyance zone. **In a flood, this zone provides space for the river to expand.** The rest of the time, it is home to natural spaces, recreational amenities, and low-impact uses that invite the river back into everyday life. This zone also enhances Drumheller's climate adaptation, helping store carbon and regulate micro-climates.

## 6. GROWTH AREAS



### BEYOND 2100

In the coming decades, Drumheller needs to move out of the river's path. This means that **new growth will happen outside of the 2100 cms line**. Limited infill below the 2100 cms line will be subject to additional conditions that make it more flood-resilient while this gradual migration occurs.

## 8. TRAILS AND OPEN SPACE NETWORK



### EDUCATION

As it is completed, **flood protection will be leveraged as an amenity**. The 2100 line will become a regional trail between the train bridges at Midland and East Coulee. This trail will tie-in to local paths that will link residents to the river and the rest of the Valley's destinations. Educational pavilions along the trail will teach visitors about the history of our valley and its changing climate.

To avoid adding a whole series of specialized additional districts, the LUB can make use of overlays. These overlays apply additional technical considerations and regulations. This approach disentangles the river from the districts, making it both easier to use and to update. It also ensures that the robust technical thinking in the MDP carries through to the Bylaw.



<b>Badlands</b>	<b>Neighbourhood Centre</b>
<b>Rural Development</b>	<b>Downtown</b>
<b>Countryside</b>	<b>Tourism Corridor</b>
<b>Neighbourhood</b>	<b>Employment</b>

### DEVELOPMENT PROCESS INTENT

- agile and adaptive to change
- simple to use and implement
- clearly articulated, not subject to broad interpretation
- form-based rather than use-focused
- business friendly
- flexible to allow for innovation and growth
- connected to the overall vision and priorities for the Valley

**RIVER**  
 ensure adequate space for the river to flow  
 build adaptive flood protection systems  
 adapt to the changing climate  
 develop an interconnected open space network  
 develop a world-class trail and pathway network  
 harness the river as an amenity

**BADLANDS**  
 protect critical viewsheds  
 maintain a sense of remoteness/solitude  
 protect ecological health and integrity  
 celebrate the badlands landscapes  
 curate the visitor arrival experience  
 foster a sense of discovery  
 provide an “escape” from city life  
 inspire locals to encourage friends & family to visit

**NEIGHBOURHOODS**  
 protect historic character and heritage assets  
 maintain unique neighbourhood identities  
 sustain a thriving downtown  
 enable a diversity of lifestyles and development  
 ensure growth is supported by existing services  
 nurture local tourism and recreation industries

**DEVELOPMENT OPPORTUNITY**  
 catalyze growth and investment  
 focus growth in safe and suitable locations  
 provide a range of housing tenures and types  
 grow within the Valley  
 connect the Valley for all modes of transportation

**POLICY DIRECTIONS**  
 river leading the way forward and connecting the Valley  
 building blocks for a locally distinct MDP  
 long term vision for the future of Drumheller Valley  
 guiding principles to inform decision-making  
 growing in safe and strategic locations  
 world-class destination and a strong local economy  
 enhancing the unique qualities of the Valley  
 a community of distinct neighbourhoods

## Digital communications impact

Prior to COVID-19 digital communications were already an effective and important tool for communicating to residents. This has become more important than ever now that face-to-face conversations are occurring less frequently.

We are actively engaged on social media through Facebook, Twitter, YouTube, and most recently – Instagram. We are also connecting to residents digitally via our website and through a monthly newsletter update. By building diverse strategies to engage the unique audiences within Drumheller we are starting to pick up more engagement and reach than ever before.

### Newsletter:

We utilize MailChimp to send out monthly newsletters. Our subscriber base continues to steadily increase thanks to referrals from the Town, through the website and through social media advertising (both organic and paid).

<b>Total Subscribers:</b>	269
<b>New Subscribers:</b>	75
<b>Number of Emails:</b>	2
<b>Avg. Open Rate:</b>	59.7%
<b>Total Views:</b>	1.4k

### Website:

Our website is our main source of information for residents of Drumheller. We have been actively posting new information and

<b>Sessions:</b>	8,222
<b>Avg. Session Duration:</b>	1 min 4 sec
<b>% New Sessions</b>	75.38%
<b>Pageviews:</b>	15,904
<b>Pages/Session:</b>	1.93

updated FAQs on a regular basis. Since July 1 we have had 16,246 impressions on Google search, with the term “drumheller flood mitigation” as our primary search term.



## Word on the trail is... Newcastle Beach will be turned into condominiums!

September 23, 2020

Hi! I'm Morris the Hike-Asaurus, and I've lived in this valley for over 70 million years and know the trails in Drumheller like the back

**MORE »**

*Sample website post - "On the Trail with Morris the Hike-Asaurus", September 2020*

SEPTEMBER 2020

WE'RE CHANGING THE  
**CHANNEL!**  
www.drumheller.ca



## NEW MUNICIPAL DEVELOPMENT PLAN & LAND USE BYLAW FIRST READING

Town council has given first reading to two cornerstone statutory documents, Bylaw 17.20 Municipal Development Plan (MDP) and Bylaw 16.20 Land Use Bylaw (LUB).

Consultation will begin on the two by-laws featuring a website where residents can provide feedback on the proposed changes, access it here: <https://landplanning.drumheller.ca/>

A public hearing is scheduled for both the MDP and LUB on Monday October 26<sup>th</sup>.

[Read the full media release here.](#)

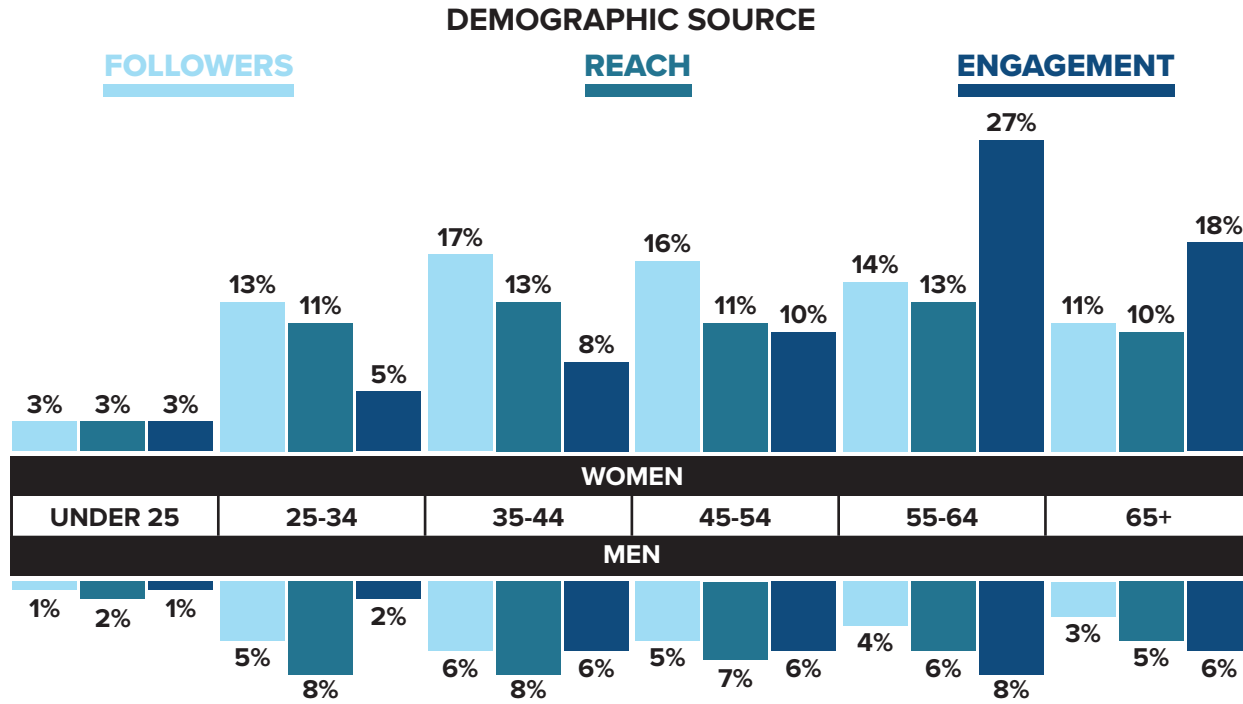
*Sample newsletter, September 2020*



*(From left to right) Junior Jensen, Darwin Durnie, Mayor Heather Colberg and Grant Adie unveiling the System 2100 Clark Hills to Hoodoos project, September 2020*

**Facebook:**

Facebook is our most popular social networking site that we use. An interesting finding about our followers shows that while the **majority of our followers are under 55**, the **majority of our engagers are over 55**.



**DrumhellerAlert**  
Published by [?] · 2 September · [?]

Current diking will be wider and higher. There will be new diking in some of the neighbourhoods that currently have no protection, where structural measures are viable. The land on top of the dikes and in the conveyance area of the river will largely become public spaces and haul routes during emergency response to floods.

Visit <https://floodreadiness.drumheller.ca/> to learn more.

### Q. WHAT WILL THE BERMS LOOK LIKE?

6m top width  
Footprint Area  
Dike Height

**DRUMHELLER VALLEY**  
We're changing the channel of the river.

@drumhellerALERT

1,870 People reached  
406 Engagements  
Boost post

3  
13 comments 7 shares

*Sample Facebook post, September 2020*

**DrumhellerAlert**  
30 July · [?]

Heather Colberg and Darwin Durnie continue their series of Flood Mitigation updates in the Drumheller Valley. We're going back in time to learn about the original flood walls in Drumheller.

1,079 People reached  
278 Engagements  
Boost post

3  
5 comments 2 shares

*Sample Facebook video, July 2020*

### BERMS/TREES/RODENTS

Understanding Tree & Rodent Impact on Berms  
Have you ever wondered why it's so important for berms to be bare? Trees and rodents can have serious impacts on berms stability, check out this video to learn how and why!

6  
2 comments 5 shares

*Sample Facebook video, September 2020*

**The Drumheller Mail** was live August 13

**Flood Mitigation Impacts on Land Use**  
Hi all... (The video starts at 36:40) Thanks for joining us today for this live broadcast from the D...  
See more  
77 comments 3.4K views

**DARWIN DURNIE**  
Resiliency and Flood Mitigation Officer

**WE'RE CHANGING THE CHANNEL**  
[www.drumheller.ca](http://www.drumheller.ca)

1:01:35 / 1:11:00

*Facebook Live event with The Drumheller Mail, August 2020*

## Instagram:

Our Instagram account launched in late September. While our account is new, we hope to increase our presence particularly with those under 45 who support the flood mitigation program.



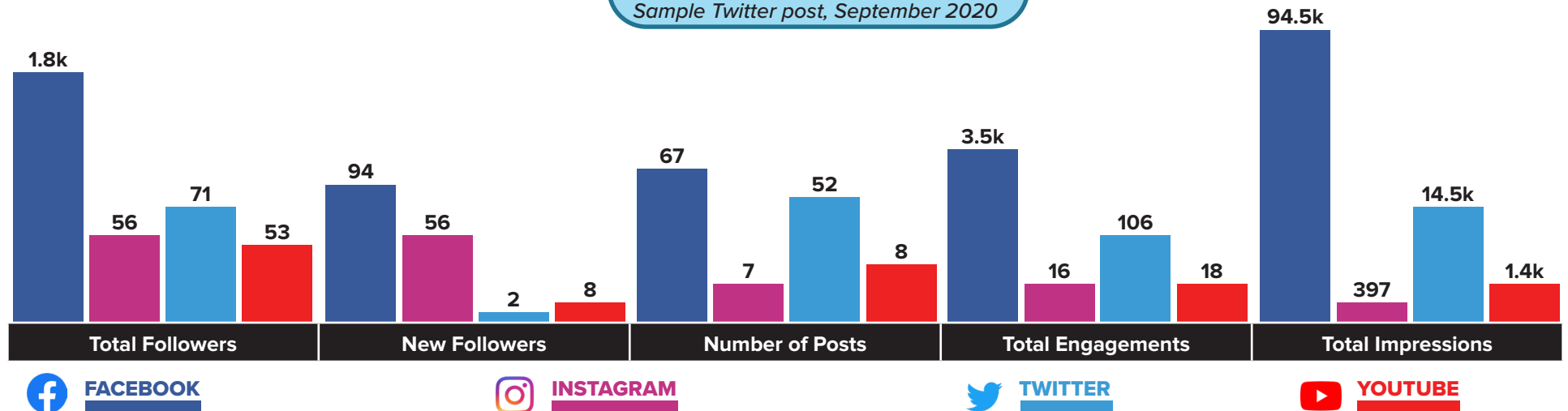
## Twitter:

Twitter the least active platform for residents of Drumheller, however for those residents we are reaching the engagement is very high.



## YouTube:

YouTube is one of our primary tools for video hosting. We continue to focus on video content overall across our social media strategy.





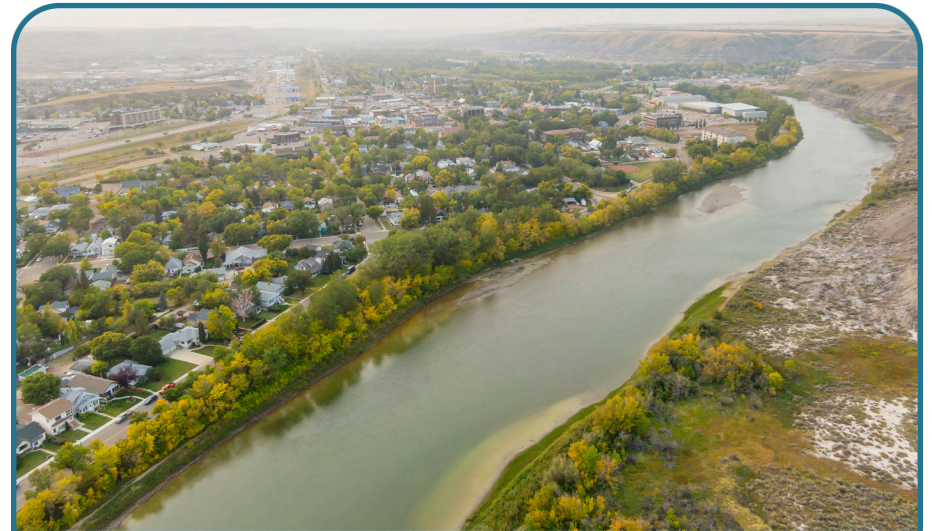
*Dike D brush clearing: before (left) and after (right), September 2020*



*Storm Detention Pond, August 2020*



*Newcastle Recreation Area, August 2020*



*Aerial footage of Drumheller, September 2020*



O2 Planning & Design River Tour, August 2020



Drumheller Farmer's Market, September 2020



Drumheller Farmer's Market, September 2020



Flood mitigation work at Newcastle Recreation Area, July 2020

## Moving forward

For the remainder of 2020 we will continue to deliver on our overall mission to protect residents and property from injury and loss related to floods and the perils of changing climate.

### SEPTEMBER

#### COMMUNICATIONS & ENGAGEMENT

- Advisory Meeting
- Sign unveiling Clark Hill to Hoodoos
- Digital media implementation
- Dike clearing communications
- MDP/LUB engagement

#### REGULATORY & APPROVALS

- MDP/LUB first reading
- Indigenous consultation application
- Annual ACRP Statement of Funding & Expenditures
- Historical Resources application

#### STRUCTURAL MEASURES

- Lift station assessment
- Clark Hill to Hoodoos CP rail line clearing and grubbing/drainage

#### CONVEYANCE CAPACITY

- Dike mowing and clearing
- Dike inspection and reporting
- Dike preliminary design

### OCTOBER

#### COMMUNICATIONS & ENGAGEMENT

- Advisory Meeting
- Financial Sector insurance meeting
- Digital media implementation
- MDP/LUB engagement
- “Know Your Flow” campaign launch

#### REGULATORY & APPROVALS

- MDP/LUB second reading
- Indigenous consultation completed
- Water Act, Navigable Waters, Fisheries/Oceans Applications
- Public Land Dispositions
- AEP dike transfer

#### STRUCTURAL MEASURES

- ROW plans and registered interest
- Urban Forest Strategy completion
- Stormwater outfall assessments
- Reinspect CN rail embankment dikes
- Survey of 5 sites
- Order riprap
- Scarlett Berm construction

#### CONVEYANCE CAPACITY

- Dike inspection and reporting
- Hydrotechnical/geotechnical analysis Nacmine
- Centennial Park detail design
- Centennial Park early works tree removal
- Dike preliminary design



# NOVEMBER

## COMMUNICATIONS & ENGAGEMENT

- Advisory Meeting
- Digital media implementation
- AEP flood inundation engagement
- Education message; grade 4-6 school visits

## REGULATORY & APPROVALS

- MDP/LUB third reading
- Socialize new flows - natural and regulated
- Historical Resources completed
- Public Land Dispositions
- AEP dike transfer

## STRUCTURAL MEASURES

- ROW plan completion
- ROW crossing agreements
- Geotechnical assessments complete

## CONVEYANCE CAPACITY

- Establish flow rate storm basins
- Dike preliminary design

## MEP UPDATES

- DEMA annual exercise

# DECEMBER

## COMMUNICATIONS & ENGAGEMENT

- Advisory Meeting
- Digital media implementation
- Grade 9-10 simulation education sessions
- Year end report

## REGULATORY & APPROVALS

- Year end reporting
- Preliminary dike designs

## CONVEYANCE CAPACITY

- Dike preliminary design

## OUR COMMITMENT

As a community dedicated to a safe and prosperous future, both on the housing, economic and cultural front, we are writing the next chapter of our story and ensuring a resilient and flood ready future. It takes a whole community approach, and together with our partners in the provincial and federal governments, we will preserve the Dinosaur Capital of Canada and share our story of adapting to a changing climate with the world.

## WE ARE A FLOOD COMMUNITY

The story of Drumheller is one of changing climate. It started under a layer of ice which melted to reveal a treasure trove of fossils deposited by the mass extinction of the dinosaurs. As the melting water sliced deep through the Great Plains, it eroded 75 million years of geological layers and created the Canadian Badlands. Of a population of 8,000 there are 2,344 residents in 1,045 dwellings at risk of direct inundation in a 1% return flood event.

Drumheller is the 3rd largest tourist destination in Alberta, but has seen its fair share of adversity from mother nature in terms of flooding:

June 27, 1915 (rain on snowmelt)  
 April 2, 1967 (ice jam)  
 June 18 1931 (rain on snowmelt)  
 June 23, 2005 (rain on snowmelt)  
 April 21, 1948 (ice jam)  
 June 21, 2013 (rain on snowmelt)  
 August 26, 1954 (rainfall)  
 April 24, 2018 (ice jam)

The Drumheller Flood Mitigation and Climate Adaptation System (DFMCAS) is a multi-hazard solution covering 100 kilometers of riverbank, that has been designed to reduce flooding and protect Drumheller into the 22nd Century. It began in April 2019 and will end March 2024. The total cost is shared by three orders of government: \$22M Canada, \$28M Alberta, \$5M Drumheller.



## Focus Areas

### Communications & Engagement

1. Promote Drumheller's approach to adapting to the perils of changing climate
2. Continuing to unite the community behind a shared purpose to protect Drumheller's economic, environmental and cultural assets from flooding
3. Consult and engage with impacted indigenous communities
4. Position Drumheller as an innovative leader in the area of flood mitigation and readiness
5. Inform affected residents of a 'fair and balanced' approach to land acquisition process
6. Communicate and work with financial and insurance sectors on viable solutions for displaced homeowners

### Regulatory & Approvals

1. Obtain transfer of existing dikes from Alberta Environment and Parks (AEP) to Town of Drumheller
2. Meet obligations of funding agreements
3. Collaborate with AEP on revised Flood hazard maps
4. Encourage economic development through updated MDP and LUB by ensuring future development proceed in areas not subject to flood risks

### Conveyance Capacity

1. Make room for the river – preserve channel capacity
2. Ensure Drumheller is prepared for inevitable flooding events caused by either an ice jam, high flow levels or intensive rainfall
3. Preserve up to 1,200 acres of natural (riparian) area that is comparable to 3,200 family cars of carbon capture per year
4. Develop a fair and balanced land acquisition policy for impacted homeowners

### Structural Measures

1. Build an adaptive system to protect the community into the 22nd century
2. Protect the cultural, palaeontological and archaeological treasures of the Red Deer River Valley
3. Develop recreational and educational interpretive centers as part of the improved flood mitigation system
4. Connect the Royal Tyrrell Museum to the Atlas Coal Mine via a 38 kilometre "2100 trail network" as part of the improved flood mitigation system

### Municipal Emergency Plan (MEP) Enhancement

1. Develop detailed flood mitigation system operations manual to accompany MEP
2. Divide river valley into manageable monitoring sectors that will allow regional partners to respond/assist appropriately to their assigned area of responsibility during emergencies
3. Establish a Flood Mitigation and Climate Adaptation operations center to effectively respond during a flood emergency
4. Implement Incident Command System (ICS) protocols throughout flood mitigation and climate adaptation office to educate staff on processes
5. Conduct annual exercises using ICS

## Achievements

- Residents were and continue to be engaged and supportive of flood mitigation and climate adaptation system
- Town of Drumheller enhances relationship with Indigenous communities as a result of consultation process
- Residents agree Town of Drumheller is a flood community
- Residents have increased knowledge about flooding in Drumheller

- All existing provincial dikes are transferred to Town of Drumheller
- Revised provincial flood hazard maps are implemented in collaboration with Town of Drumheller
- Future flood plain development in Drumheller is improved through changes to MDP and LUB
- Support from funding partners is maximized

- Channel capacity in Red Deer River is improved/preserved
- Land Acquisition program is successfully completed to remove structures from floodway
- Innovate environmental initiatives were implemented to preserve riparian areas and urban forests
- Projected green house gas reductions of 3200 cars per year equivalent is met

- Enhanced diking system withstands future flooding by being adaptive to future
- Diking network between Royal Tyrrell Museum and Atlas Coal Mine serves as experiential education system for 500,000 annual visitors
- Majority of projected 20,000 man hours to complete work are hired locally

- Town of Drumheller staff are trained to respond to future flooding
- Regional partners manage prescribed monitoring sectors of the river valley
- MEP is updated and meets Bill 8 requirements

## Goal

The Town of Drumheller has protected the residents and property from loss or injury related to the perils of floods and changes in climate. The risk to property is reduced, thereby preserving economic viability of the community.

## Success

- Confidence of residents
- Decreased vulnerability and exposure areas
- Increased economic activity in 5 years
- Increased river capacity
- Improved climate adaptation
- Increased staff capacity to respond to future emergencies

## Risks

- Increasing likelihood of natural disasters
- Changes to the provincial flood hazard maps
- Project delays due to regulatory & approvals process
- Loss of local human resource expertise
- Ineffective communication and engagement



# Drumheller Flood Mitigation and Climate Adaptation System

Changing the Channel  
on Flood Readiness

September 2020



# DRUMHELLER IS A FLOOD COMMUNITY



**8,000**

POPULATION



**12**

NEIGHBOURHOODS



**100**

KILOMETRES OF RIVERBANK



## HISTORIC FLOOD YEARS

**1902 1915 1932 1954 1991 2005 2013 2018**

**ROI**

EXCEEDS 2:1

- ✓ Making room for the river
- ✓ Reinforcing existing measures

## GOALS

- ✓ Building an adaptive system to protect the community into the 22<sup>nd</sup> century
- ✓ Changing the channel on flood-readiness

## Green House Gases

3200 cars per year equivalent land preservation area dedicated



**2019**

COMMENCE DATE



**2024**

COMPLETION DATE

**20,000**

STAFFING HOURS



**4,000**

LOCAL STAFFING HOURS (JANUARY - SEPTEMBER)

The next historic flood is not a matter of “**IF**” but “**WHEN**”